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Translation from the Polish language

Cable television network access-management system and method for management of receivers operating within cable television network

The object of the invention is a system for management of access to a cable television network and a method for management of receivers operating a cable television network.

A system for management of access to a cable television network is known from the US Patent No. 5,748,732 which describes a method for management of access to the network and a device for controlling access to the network through a master decoder and a slave decoder. The master decoder receives information from a central management device for controlling the operation of the slave decoder, which it sends to the slave decoder after an electronic card of the slave decoder is placed in a reader of the master decoder and information is read therefrom.

The object of the invention is the fact that in a cable television network access-management system comprising at least one master decoding device provided with an electronic card, and at least one slave decoding device linked to it, and a transmitter device which generates and transmits messages allowing for the usage of the master and slave decoding devices and receivers linked to them, the master decoding device and at least one slave decoding device linked together are located in a defined distance and operate when a distance between them does not exceed the nominal distance dependent upon a configuration, a number and a quality of splitters and connections.

Preferably a decoding device is assigned the status of the master decoding device only after it has been linked to a network and an entitlement control message for the master decoding device have been found.

Preferably the master decoding device, linked as the first device, imposes on the transmitter device a transmission of the entitlement control messages appropriate for the master decoding device.

Preferably a decoding device is assigned the status of the slave decoding device only after it has been linked to a network and an entitlement control messages for the slave decoding device have been found.

Preferably the slave decoding device, linked as the first device, imposes on the transmitter device a transmission of the entitlement control messages appropriate for the slave decoding device.

Preferably the master decoding device and the slave decoding device, when they are turned on, first check if any messages are being transmitted by other devices before they start to transmit messages.

Preferably the slave decoding device, linked as the first device, triggers the master decoding device to transmit the entitlement control messages appropriate for the slave decoding device and messages with demand for coupling.

Preferably a period of time for coupling the master decoding device with the slave decoding device is pre-set.

Preferably the slave decoding device is provided with an electronic card.

Preferably the distance between the master decoding device and the slave decoding device linked to it is determined from the level of a signal exchanged between them.

Preferably when measuring the distance between the master decoding device and the slave decoding device linked to it, the level of signal sent between them is compared to the level of signal from the previous session.

Preferably the status of the master decoding device and at least one slave decoding device linked to it is assigned after transmission of encoded

messages by the transmitter device generating and transmitting specific codes.

Preferably a private television network shares the same medium with a public cable television network.

Preferably the messages for managing the master decoding devices and at slave decoding devices are generated by a generator, which is connected to a multiplexer through a generator, which generates information, and messages for managing the master decoding devices and the slave decoding devices are contained in the entitlement control messages.

Preferably sending the messages managing the access to the network for the master decoding device and at least one slave decoding device linked to it, is performed after encoded messages are transmitted by the transmitting device, generating and transmitting specific codes.

The object of the invention is also a method for management of receivers provided with electronic cards and linked to a television cable network, among which at least one device is the master decoding device with which at least one slave decoding device is linked, and a transmitter device which generates and transmits messages that allow to use the master and the slave decoding devices and receivers connected to them, the master decoding device and at least one linked slave decoding device are installed at a defined distance from each other so that the master decoding device and the slave decoding device will operate only if the distance between them does not exceed the defined nominal distance dependant upon the configuration, the quantity and the quality of splitters and links.

The object of this invention is shown in implementation examples in the enclosed drawings, in which fig. 1 illustrates a block scheme of system management, fig. 2, 3, 4, and 5 illustrate block schemes of master and slave set-top boxes interconnections, fig. 6A and 6B illustrate a flow diagram of an algorithm of set-up process, fig. 7A and 7B illustrate a flow diagram of an algorithm of installing a set-top box as slave, fig. 8A, 8B, 8C and 8D illustrate a flow diagram of an algorithm of installing a set-top box as master, fig. 9A, 9B and 9C illustrate a flow diagram of an algorithm of setting up a test signal, fig.

10 illustrates a flow diagram of an algorithm of sending signal, fig. 11A and 11B illustrate a flow diagram of an algorithm for setting the status of decoders.

The television network system presented in fig. 1 comprises a Subscriber Management System 1, (SMS), which stores information about clients and assigned electronic cards, and which is connected with a Conditional Access System 2, (CAS), and with a system for management of set-top boxes, referred to as decoders, called a Master Slave System 3, (MSS). The Conditional Access System 2 through a generator 4 generating Entitlement Control Messages, (ECM), sends messages to a multiplexer 5 which multiplexes different data streams into one integrated stream of data. The multiplexer 5 receives also messages from a generator 6 creating Entitlement Management Messages, (EMM), messages from a generator 7 that generates decoder management messages, which are messages allowing coupling between master and slave decoders, so-called Set Coupling Messages, (SCM), messages concerning the master decoder verification key, called Session Key Messages, (SKM), and messages used to reset the coupling of the master and the slave decoder, called Reset Coupling Messages, (RCM).

The entitlement control messages, ECMs, are messages used to decrypt the stream of data, and contain a symmetrical private key, which is used both by the transmitting and the receiving device. The entitlement control messages are encrypted with the use of an asymmetrical key, whose private part resides in the transmitting device and public part is sent in the entitlement management messages, EMMs. Entitlement management messages contain information necessary for decoding entitlement control messages, which means that the entitlement control messages are controlling the access to the data stream, and the entitlement management messages are controlling the access to the entitlement control messages.

The integrated stream of data from the multiplexer 5 is sent, over a public network 8, to the master decoders 11 and the slave decoders 12, 15, which are provided with a device 16 for coding and reading electronic cards 17. The master decoders 11 and the slave decoders 12 are additionally linked

through a private television network 13, within which, after the decoders have been coupled, various messages 14, called Master Slave Messages, (MSM), are sent. In particular solutions, the private television network 13 can share the physical medium with the public network 8. In the case of the shared medium, elements of the public network 8, i.e. cables, splitters, are used, for example, to pass coupling messages for the master decoder 11 and the slave decoder 12.

Figs 2, 3, 4, and 5 illustrate different configurations of links between the set-top boxes or decoders through the private network 13 shown in fig.1. A cable terminal 185, shown in fig. 2, led to a building, has a two-way splitter 184 from which cables are led to the next two-way splitters 183, 186 in different apartments. In one of the apartments, there are the master decoder 182 and the slave decoder 181 whilst the master decoder 188 and the slave decoder 187 assembly is located in the second apartment. In each apartment, decoders can be placed in different rooms. In another arrangement the cable 195, shown in fig. 3, is led to the building and is terminated with a two-way splitter 194 from which cables are led to a second two-way splitter 196 and a four-way splitter 193 located in different apartments. In one of these apartments, there are the master decoder 192 and three slave decoders 191, 197, 198, while the master decoder 200 and one slave decoder 199 are located in the second apartment. In another possible arrangement the cable 201, shown in fig. 4, is led to the building and is provided with a four-way splitter 212 from which cables are led to further four-way splitters 202, 207 located in two different apartments. In one of these apartments, there are the master decoder 203 and three slave decoders 204, 205, 206. In the second apartment the identical system is installed: the master decoder 208 and three slave decoders 209, 210, 211. In the final layout, the cable 225, shown in fig. 5, is led to the building and has a four-way splitter 224 from which one cable is linked to a two-way splitter 223 with the master decoder 226 and the slave decoder 227 connected in one apartment but in two different rooms. The second cable from the splitter 224 is led to a four-way splitter 221 in a second apartment where the master decoder 222 and three slave decoders 228, 229,

230 are linked.

Each of the decoders, shown in figs 2, 3, 4, and 5, after linking to the cable television network has a specific placement in the network and, as seen on the exemplary layouts, each of the slave decoders is interrelated with a defined master decoder and can not change its position without modification of the settings. It means that the decoder cannot be moved from one place to another. It can be moved only in specific limits defined by a configuration, a number and a quality of splitters and links between these two decoders. A change of position, followed by a change of link configuration, results in change of the signal level passing from one decoder to another, resulting from the change of resistance of cables between the decoders and their links. To detect changes in the decoder location in the present solution, a minimal signal level, necessary to make the connection between the master decoder and the slave decoder possible, depending on the location of the slave decoder within the network, is used. This signal level is very specific for each decoder and allows for a calculation of a logical distance between the decoders. In the case of public and private networks, the cables connecting the decoders, as well as the characteristics of the splitters, are used in the estimation of the distance between the master and the slave decoders. This distance is defined as a minimum signal level necessary to pass a message from the master to the slave decoder or vice-versa. The master and the slave decoders memorise the minimum signal level used during the previous communication and compare it with the signal level during the next operation or while checking the stability of the configuration. If the difference in the signal level is greater than a permissible value with a certain margin, an error message will be sent, and certain actions are taken, assuming that if the network has not been modified, the environment should not change within a short period of time. In the suggested solution, a particular decoder should be able to modify a signal level within at least a 50 dB range in one decibel increments.

The operation of the system for management of access to the cable television network and other systems, including a system for management of

decoders, is based on software. Specific algorithms assigned to different types of decoders and functions served by them are presented in the next figures.

Figs 6A and 6B illustrate an algorithm of operation of the system for management of decoders. After the decoder is turned on, in the starting step 21, the mode of operation and the status of the decoder, initially unknown, as it is stated in table 23, are restored in step 22. Next, in step 24, the mode of the decoder is verified in attempt to determine its master or slave role. At the same time it is checked whether any disconnection occurred between the master and the slave decoders during the last communication. In case of occurrence of such a disconnection, video display is disabled in step 25. In the opposite case, the state of the decoder is verified in step 26, and if it is still unknown, the status of the decoder is initialised in step 27. In step 28 a search is performed for entitlement control messages relating to information pertaining the coupling with the master decoder. If they are not found in step 29, and the session time has elapsed in step 30, after waiting 10 seconds in step 31, a new attempt to find the entitlement control messages is performed. Once entitlement control messages are found, they are sent to the electronic card in step 32 and next it is checked in step 33 if the decoder is authorised for this coupling message. In the case of a positive answer, the operating mode of the master decoder is granted to the decoder in step 34. In the case of a negative answer, in step 35, the operating mode of the slave decoder is granted to the decoder and the decoder is assigned an inactive status, and in both cases the system resumes operation in steps 36 and 37.

If the mode of the decoder is recognised as known, in step 40 the demultiplexer is set to send the messages concerning the master decoder verification key, and messages allowing to reset the coupling of the master and the slave decoder. When it is determined in step 41 that the decoder operates in the master mode, in step 42 the demultiplexer is set to send messages allowing coupling between master and slave decoders and the decoder is ordered to operate in the master mode in step 43. In the opposite case, it is ordered in step 44 to work in the slave mode. After obtaining in step 45 messages from the demultiplexer, after certain period, and verification that

they refer to coupling between master and slave decoders, in step 47 the decoders are coupled and the slave decoder data are stored. If it is verified in step 48 that the messages refer to the master decoder verification key, the data relating to the session are stored in step 49. If it is verified in step 50 that the messages refer to the reset of the coupling of the master and the slave decoder, in step 51 the decoder is deleted from a slave decoder list, the session key is removed, the mode of the decoder is set as unknown, the decoder is disabled in step 52, and the system operation is resumed in step 53.

Figs. 7A and 7B illustrate an algorithm of operation of the slave set-top box or the slave decoder, which, when turned on in step 61, waits in step 62 for a message from the master decoder after coupling is established. A call for coupling can be repeated when a coupling order is received in step 63. If the set coupling message is positively verified in step 64, then it is further verified in step 65 to find whether this message allows video to be displayed. For the coupled slave decoder, for which the coupling time has expired, which is checked in step 67, the video is again enabled in step 66. The non-coupled decoder is set as the coupled one in step 68, and a repetition of the process is followed in steps 60 or 69.

If the received set coupling messages are not correct, it is checked in step 70, whether the decoder is already coupled or whether it is the first coupling. A negative answer is followed by a verification in step 71 whether the decoder is in the state of coupling or is already coupled, and if not, the coupling process is repeated in step 59. If the decoder is not coupled, it is checked in step 72 if the coupling time is longer than the allowed coupling time and if it is not exceeded, in step 73 a message with a call for coupling is sent. In step 74 it is checked if the time for receiving a message allowing video display has expired and if it has expired, in step 76, a message calling for coupling is sent. Then, in step 75, it is checked if the time for video display has expired and if it has expired, in step 77 the status of the decoder is changed to the time-expired status, followed by disabling video in step 78, next an error message is sent in step 79, and a coupling repetition takes place in step 80.

which is also repeated if the time for coupling has expired.

Figs 8A, 8B, 6C and 8D illustrate an algorithm of operation of the independent set-top box or a master decoder, which, when turned on in step 81, waits in step 82 for a message which is verified in step 83. Then, in step 84, it is checked whether the status of the master decoder meets requirements of the coupling process. If the answer is negative, the status of waiting for a message is resumed and the procedure proceeds from step 85 to step 86. A check is made in step 87 as to whether the received message is a request for coupling. A negative answer is followed by the return from step 88 to step 86. If the verification is positive, a ping message is sent in step 89. In step 90 the status is examined, which should refer to the status of coupling with the slave decoder. If the answer is positive, in step 91 a threshold signal level is stored and the status of the decoder is set to slave and connected. A message is sent in step 92 to the coupled slave decoder to enable video. The signal level is checked in step 93, and if it differs from the signal more than a permissible margin, in step 94 the slave decoder is granted with a status of being disconnected, an error message is sent in step 95, and the procedure moves from step 96 to step 86. In step 97 a verification is carried out to decide if the time assigned for coupling the master decoder has expired, and then in step 98 it is checked if the assigned time has expired. Beginning from step 99, in steps 100, 101, and 102 the mode of each active decoder is compared with the mode of the slave and connected decoder and a message is sent to enable video display, and the procedure moves from step 103 to step 86.

In case when the time for the master decoder has expired, in step 104, the verification process of each active slave decoder is carried out, beginning with a ping message sent to the first slave decoder in step 105, and then in step 106 a signal level is compared to a certain set level with an allowed margin. The process of verification of the active slave decoders ends in step 111 and 112. If the difference in the signal level is not greater than an allowed margin, a new threshold signal level is stored in step 107, and in step 108 information to enable video display is sent. If the signal differs from the one stored during the last session, in step 109 the slave decoder is granted with

the status of non-connected, and an error message is sent in step 110.

Figs 9A, 9B, and 9C illustrate an algorithm of sending a ping message to a chosen location within a television network. The algorithm starts in step 115 and in step 116 the following parameters are established: the maximum number of steps, the maximum signal level which equals two raised to the power of the maximum number of steps, the power of signal equal to half of the maximum signal power, the preliminary robustness, and the step which equals unity. Next, a coupling message is sent in step 117 and a message confirming the coupling is received in step 118. In step 119 it is checked if the time predicted to receive an answer to the ping message has expired. Calls for ping message repetitions are transmitted in step 114. If the waiting time predicted to receive confirmation of coupling is exceeded, in step 132 it is checked whether the robustness is greater than zero, and in step 133 whether the step number is less than the maximum number of steps. For a negative answer the signal level is stored in step 134 and the process of sending the ping message ends in step 135. In step 136 the step number is increased, the signal power is established as equal to the maximum power divided by two raised to the number of incremental steps, the initial robustness is set, followed by the repetition of sending the ping message in step 137. In step 140 it is checked if the step number is smaller than the maximum number of steps. If the answer is positive, in step 143 the number of steps is increased, and in step 144 the signal power is established as being equal to two raised to the number of incremental steps, the initial robustness is set, followed by the repetition of sending the ping message in step 145. The robustness, set in step 144, is a parameter used to establish the number of ping operations, which have to take place until communication is recognised as unsuccessful. For a step number not less than the maximum step number, the signal level is recorded in step 141 and the process of sending the ping message ends in step 142.

Fig. 10 illustrates an algorithm of sending messages. After start in step 120, the N number is set to zero in step 121. In step 122 the decoder waits for silence in the network, which is repeated after a command sent in step 129. A

decoder, which does not need to transmit data, initially checks if any other decoder has started sending messages to it. Similarly, if the decoder has messages to transmit, it listens within the network for signals transmitted from the other decoder, which means that the former is tuned to a carrier, and messages are sent only if no other signal is detected and the private network is idle. In step 123 a message is sent, in step 124 a message is received. In step 125 it is verified if after sending a message, the same message is received. If there is no collision, i.e. messages sent and received are the same, the algorithm ends in step 126. In case of collision, in step 127 the number N is increased followed by waiting in step 128 by a random waiting time and the message is again send in step 129. A formula to calculate the period of waiting is described in table is set in step 260.

Figs. 11A and 11B illustrate a diagram of states of decoders within the television network. At the moment of start of any decoder 171, its mode and status are not predetermined, which implies that the current mode and status of the decoder 172 are unknown. When the decoder 174, 175, 176, 177, 178, 179, receives a message used to reset coupling 281, it changes its state to unknown 172. A decoder being in unknown 172 state always sets itself into the undetermined 174 mode and initialises its operation. The decoder operates in this state until it receives an entitlement message 282. If the decoder, being in the undetermined mode 174, receives the message 284 assigning the mode of acting as a master, the decoder changes its mode to the 175 master decoder in a coupling state. When a message 285 assigning the mode of a master decoder is received, the decoder changes its mode 176 to that of a master decoder in a coupled state, retaining this state as long as it is getting messages 286 about coupling. This status is changed when a reset coupling message 281 is received and then the decoder changes its state 172 to undetermined mode and status.

If the decoder 174 of undetermined mode does not receive 284 a message assigning the master mode, which is described in block 283, the decoder changes its mode to act as the slave decoder 177 having the coupling status. When the coupling message 289 is received, the decoder changes its

mode to the slave decoder 179 with coupled status, retaining this status as long as it is receiving coupling messages 291. This state is modified if either a period of operating video expires and the decoder is attributed the state of the timeout 178, or a reset coupling message 281 is received, resulting in a change of the decoder 172 state to undetermined mode and status.

If the decoder 177 in the slave mode during the coupling period is not provided with the message 289 about successful coupling, which is described in block 288, it changes its mode to a slave decoder 178 with expired operating time. The decoder remains in this state until it receives a message 290 about coupling.

The described solution protects the cable television receivers from moving from a place where the master receiver of the master decoder is installed. Overall, the presented solutions refers to a system for management of decoders, which generates information coupling the master decoder with the slave decoder and a session key, which is used for coding and decoding data sent by the master decoder to the slave decoder through a private network. The system of management of decoders generates information for each pair of master-slave decoders, as well as the key to the transmitting session.

The functional and characteristic elements of the solution are the facts that the identification of the roles of the master and the slave decoders and the coupling between decoders is performed by with the use of the number for the electronic card which is assigned individually to each decoder, and the new decoder connected to the network operates neutrally for a specific period of time or until it receives information about its role, and if it does not receive a message in a certain time, it turns off. The master decoder communicates with the slave decoder in order to activate it, and the inactive slave decoder can be activated again after it is connected to a master decoder, which can identify the distance to the slave decoder through the network and use this to deactivate a moved slave decoder. The coupling between the decoders may be resumed anytime by the network.

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CLAIMS

1. A cable television network access-management system comprising at least one master decoding device provided with an electronic card, and at least one slave decoding device linked to it, and a transmitter device which generates and transmits messages allowing for the use of the master and slave decoding devices and receivers connected with them, characterized in that the master decoding device (11) and at least one slave decoding device (12) linked with it are located in a defined distance and operate when the distance between them does not exceed the nominal distance dependant upon a configuration, a number and a quality of splitters and connections.

2. The cable television network access-management system, according to claim 1, characterized in that a decoding device is assigned the status of the master decoding device (11) only after it has been linked to a network and an entitlement control message for the master decoding device (11) has been found.

3. The cable television network access-management system, according to claim 1, characterized in that the master decoding device (11) imposes as the

first on the transmitter device (3) a transmission of the message controlling the access to the network appropriate for the master decoding device (11).

4. The cable television network access-management system, according to claim 1, characterized in that a decoding device is granted with a mode of the slave decoding device (12) only after it has been linked to a network and a message controlling the access to the network appropriate for the slave decoding device (12) has been found.

5. The cable television network access-management system, according to claim 1, characterized in that the slave decoding device (12) imposes as the first on the transmitter device (3) a transmission of the message controlling the access to the network appropriate for the slave decoding device (12).

6. The cable television network access-management system, according to claim 1, characterized in that the master decoding device (11) and the slave decoding device (12), when they are turned on, first check if any messages are being transmitted by other devices before they start to transmit messages.

7. The cable television network access-management system, according to claim 1, characterized in that the slave decoding device (12) when turned on as the first, triggers the master decoding device (11) to transmit the message controlling the access to the network appropriate for the slave decoding device (12) and messages with demand for coupling.

8. The cable television network access-management system, according to claim 7, characterized in that a period of time for coupling the master decoding device (11) with the slave decoding device (12) is pre-set.

9. The cable television network access-management system, according to claim 1, characterized in that the slave decoding device (12) is equipped with an electronic card (17).

10. The cable television network access-management system, according to claim 1, characterized in that the distance between the master decoding device (11) and the slave decoding device (12) linked to it is determined from the level of a signal exchanged between them.

11. The cable television network access-management system, according to claim 4, characterized in that during determining the distance between the master decoding device (11) and the slave decoding device (12), the level of signal sent between them is compared to the level of signal from the preceding communication.

12. The cable television network access-management system, according to claim 1, characterized in that the status of the master decoding device (11) and at least one slave decoding device (12) linked to it is granted after transmission of encoded messages by the transmitter device (3) generating and transmitting specified codes.

13. The cable television network access-management system, according to claim 1, characterized in that a private television network (13) shares the medium with a public cable television network (3).

14. The cable television network access-management system, according to claim 1, characterized in that sending the messages managing the access to the network for the master decoding device (11) and at least one slave decoding device (12) linked to it, is performed after encoded messages are transmitted by the transmitting device (3), generating and transmitting specific codes.

15. The cable television network access-management system, according to claim 1, characterized in that the messages managing the master decoding devices (11) and the slave decoding devices (12) are generated by a

generator (7) connected to a multiplexer (5) through another generator (6) which creates messages, and the messages managing the master decoding devices (11) and the slave decoding devices (12) are included in the messages managing the access to the network.

16. A method for management of receivers provided with electronic cards and linked to a cable television network, among which at least one device is the master decoding device, to which there is connected at least one slave decoding device and a transmitter device which generates and transmits messages allowing to use the master and the slave decoding devices and receivers connected to them, characterized in that the master decoding device (11) and at least one slave decoding device (12) linked to it are installed at a defined distance from each other, which results in that the master decoding device (11) and the slave decoding device (12) operate only if the distance between them does not exceed the nominal distance dependant upon a configuration, a number and a quality of splitters and connections.

17. The method for management of access to a cable television network according to claim 16, characterized in that a decoding device is assigned the status of the master decoding device (11) only after it has been linked to a network and an entitlement control message for the master decoding device (11) has been found.

18. The method for management of access to a cable television network according to claim 16, characterized in that the master decoding device (11) imposes as the first on the transmitter device (3) a transmission of the message controlling the access to the network appropriate for the master decoding device (11).

19. The method for management of access to a cable television network according to claim 16, characterized in that a decoding device is granted with a mode of the slave decoding device (12) only after it has been linked to a

network and a message controlling the access to the network appropriate for the slave decoding device (12) has been found.

20. The method for management of access to a cable television network according to claim 16, characterized in that the slave decoding device (12) imposes as the first on the transmitter device (3) a transmission of the message controlling the access to the network appropriate for the slave decoding device (12).

21. The method for management of access to a cable television network according to claim 16, characterized in that the master decoding device (11) and the slave decoding device (12), when they are turned on, first check if any messages are being transmitted by other devices before they start to transmit messages.

22. The method for management of access to a cable television network according to claim 16, characterized in that the slave decoding device (12) when turned on as the first, triggers the master decoding device (11) to transmit the message controlling the access to the network appropriate for the slave decoding device (12) and messages with demand for coupling.

23. The method for management of access to a cable television network according to claim 22, characterized in that a period of time for coupling the master decoding device (11) with the slave decoding device (12) is pre-set.

24. The method for management of access to a cable television network according to claim 16, characterized in that the slave decoding device (12) is equipped with an electronic card (17).

25. The method for management of access to a cable television network according to claim 16, characterized in that the distance between the master decoding device (11) and the slave decoding device (12) linked to it is

determined from the level of a signal exchanged between them.

26. The method for management of access to a cable television network according to claim 20, characterized in that during determining the distance between the master decoding device (11) and the slave decoding device (12), the level of signal sent between them is compared to the level of signal from the preceding communication.

27. The method for management of access to a cable television network according to claim 16, characterized in that the status of the master decoding device (11) and at least one slave decoding device (12) linked to it is granted after transmission of encoded messages by the transmitter device (3) generating and transmitting specified codes.

28. The method for management of access to a cable television network according to claim 16, characterized in that sending of messages through a private television network (13) and a public cable television network (3) is performed through a shared medium.

29. The method for management of access to a cable television network according to claim 16, characterized in that the status of the master decoding device (11) and at least one slave decoding device (12) linked to it, is assigned after encoded messages are transmitted by the transmitting device (3), generating and transmitting specific codes.

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ABSTRACT

In a system for management of access to a cable television network comprising at least one master decoding device (11) provided with an electronic card (17), and at least one slave decoding device (12) linked to it, and a transmitter device (3) which generates and transmits messages allowing for the use of the master (11) and slave (12) decoding devices and receivers connected with them, characterized in that the master decoding device (11) and at least one slave decoding device (12) linked with it are located in a defined distance and operate when the distance between them does not exceed the nominal distance dependant upon a configuration, a number and a quality of splitters and connections.

29 claims

Fig. 1

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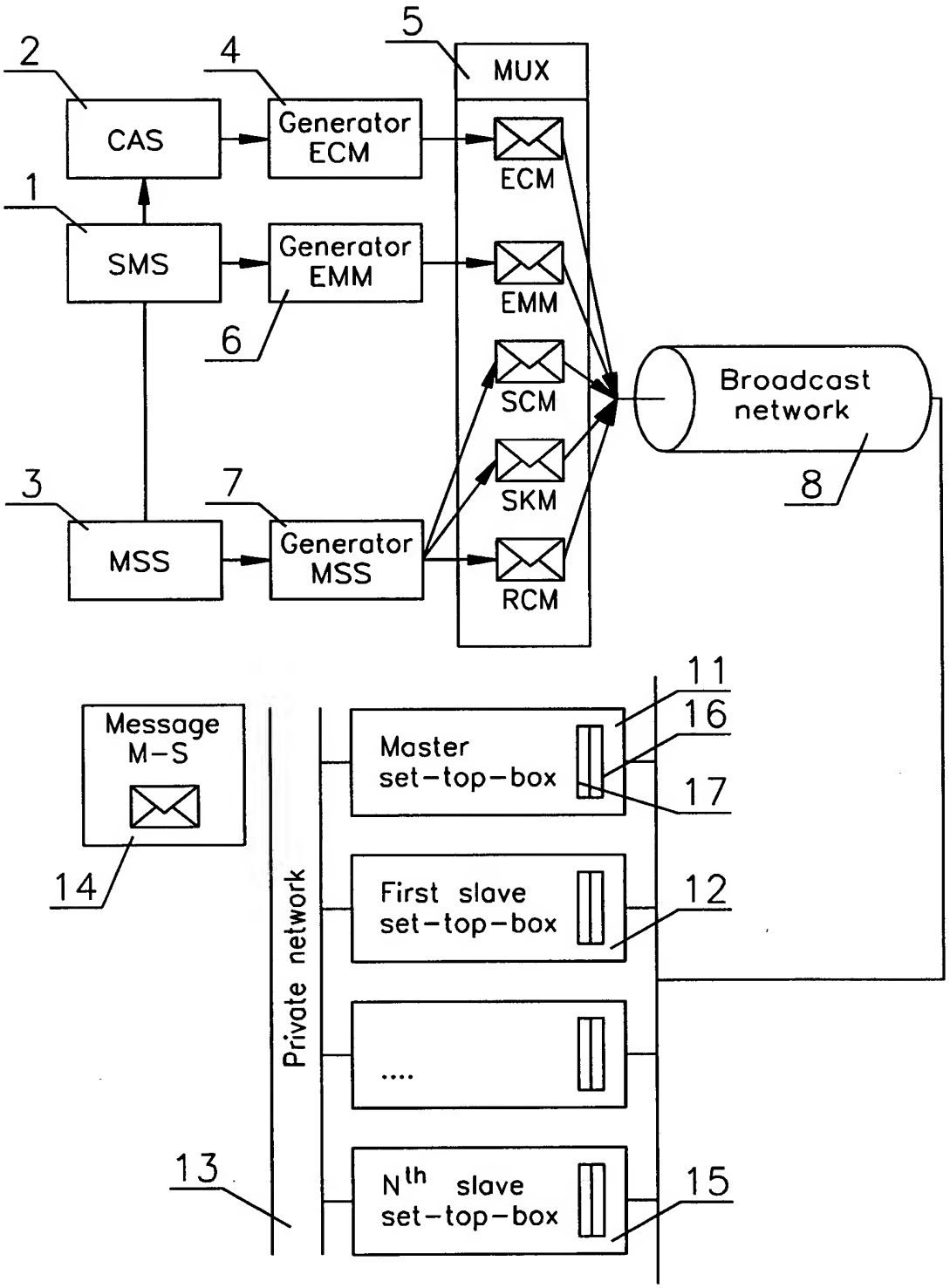
5
MUX
2
CAS
4
Generator ECM
ECM
1
SMS
Generator EMM
EMM
6
SCM
Broadcast network
8
SKM
3
MSS
7
Generator MSS
RCM
11
16
Message M-S
Master set-top-box
17
14
Private network
First slave set-top-box
12
....
13
Nth slave set-top-box
15

Fig.1

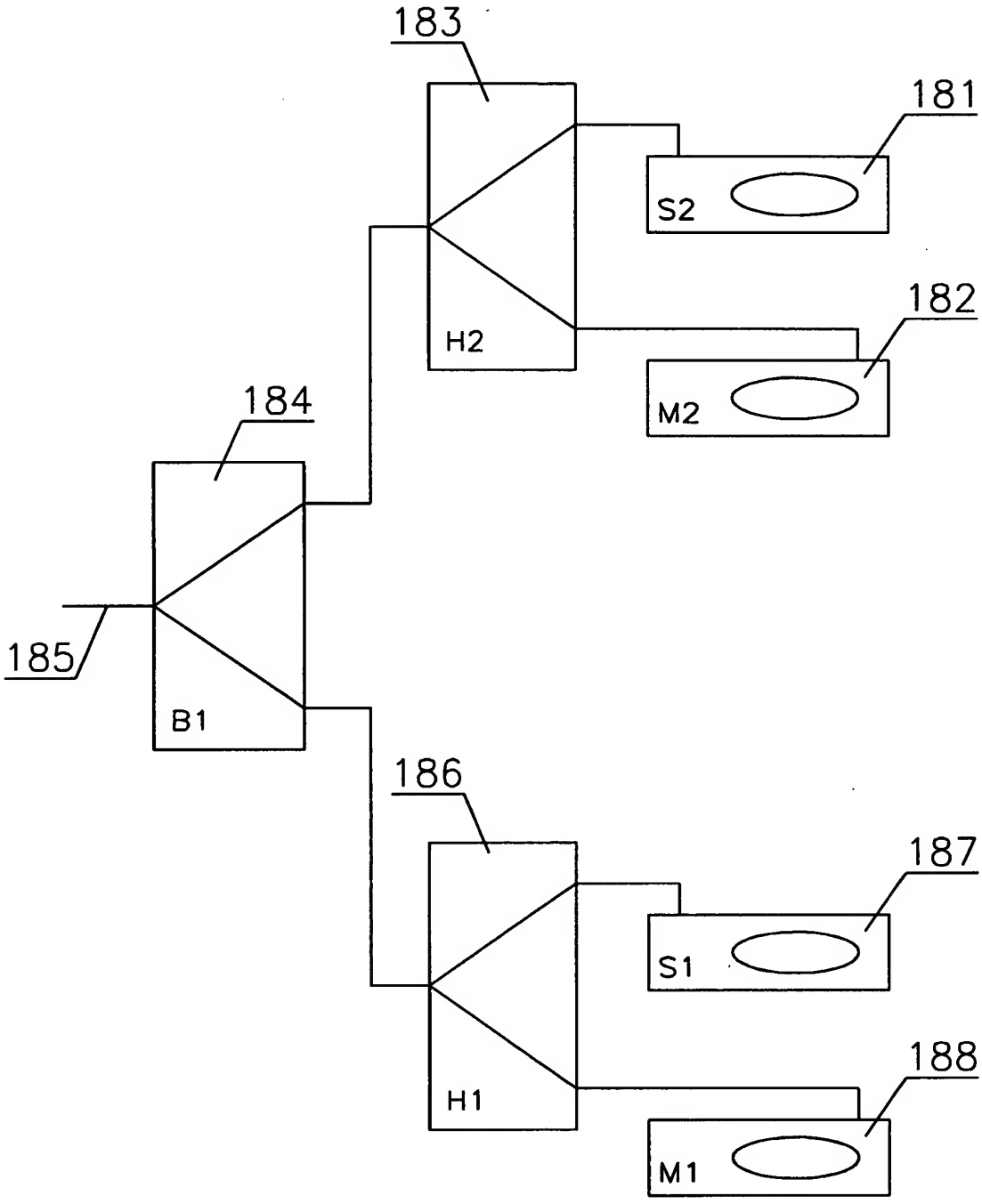

Fig.2

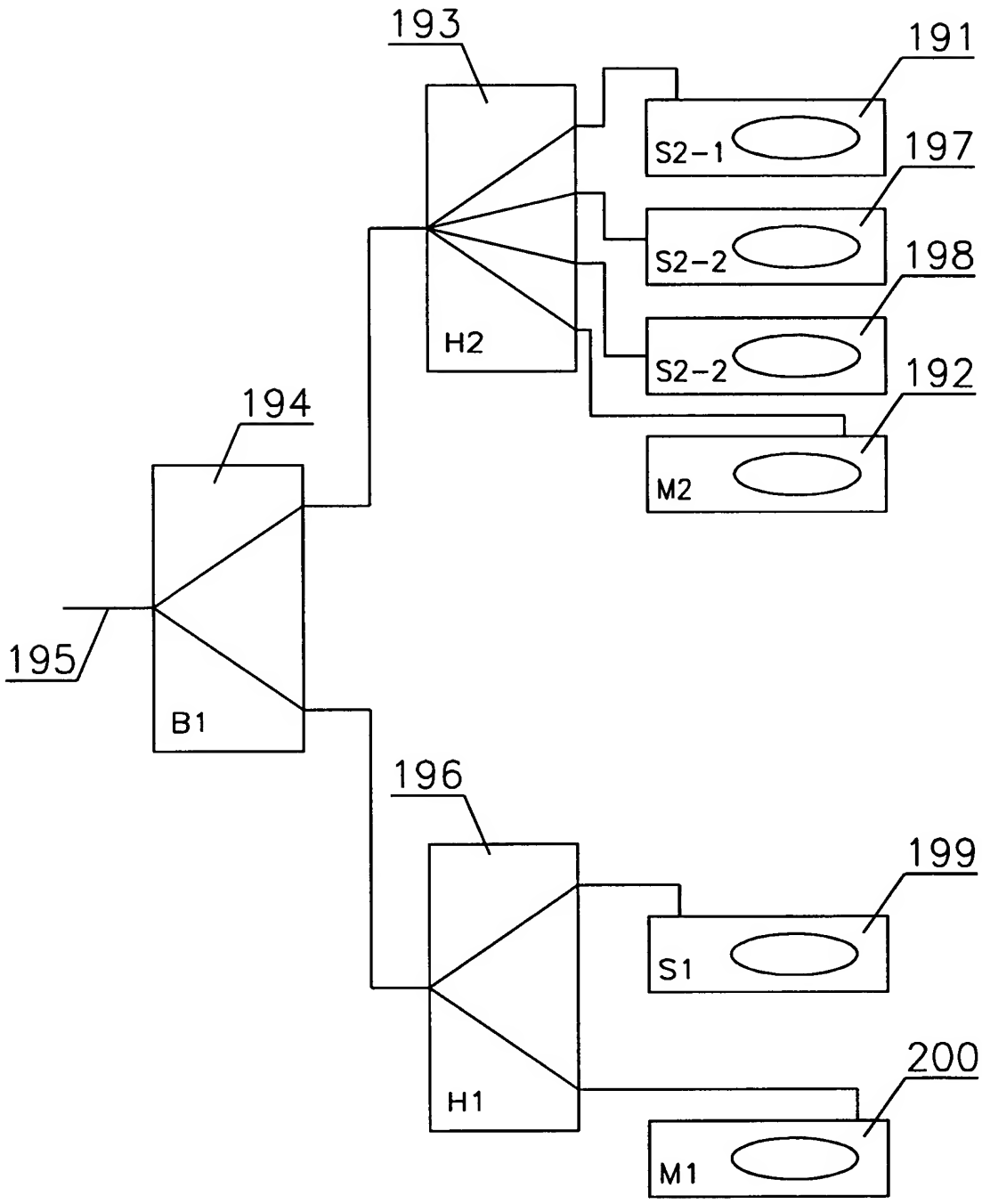

Fig.3

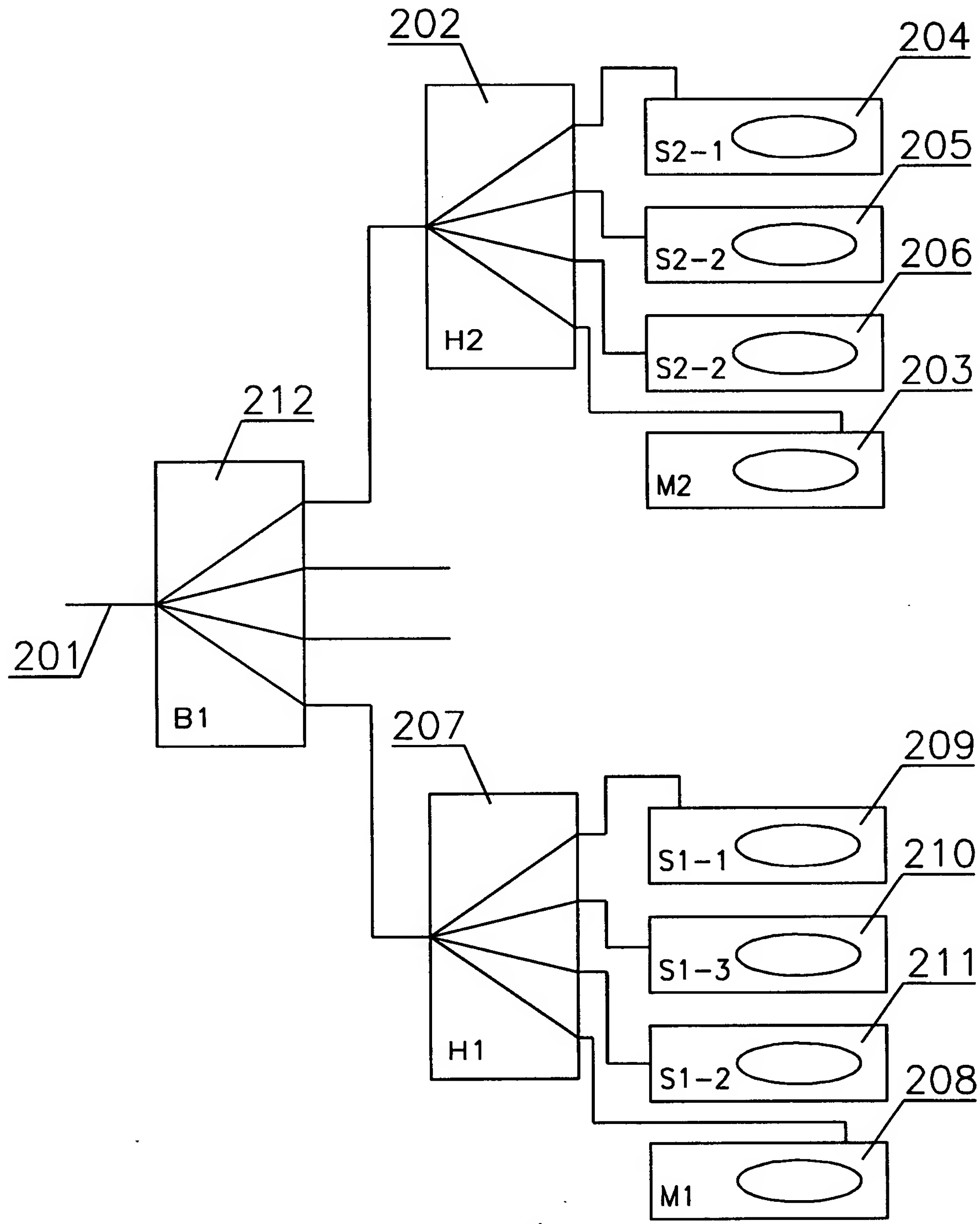
202
204
S2-1
205
S2-2
206
H2
S2-2
203
212
M2
201
B1
207
209
S1-1
210
S1-3
211
H1
S1-2
208
M1

Fig.4

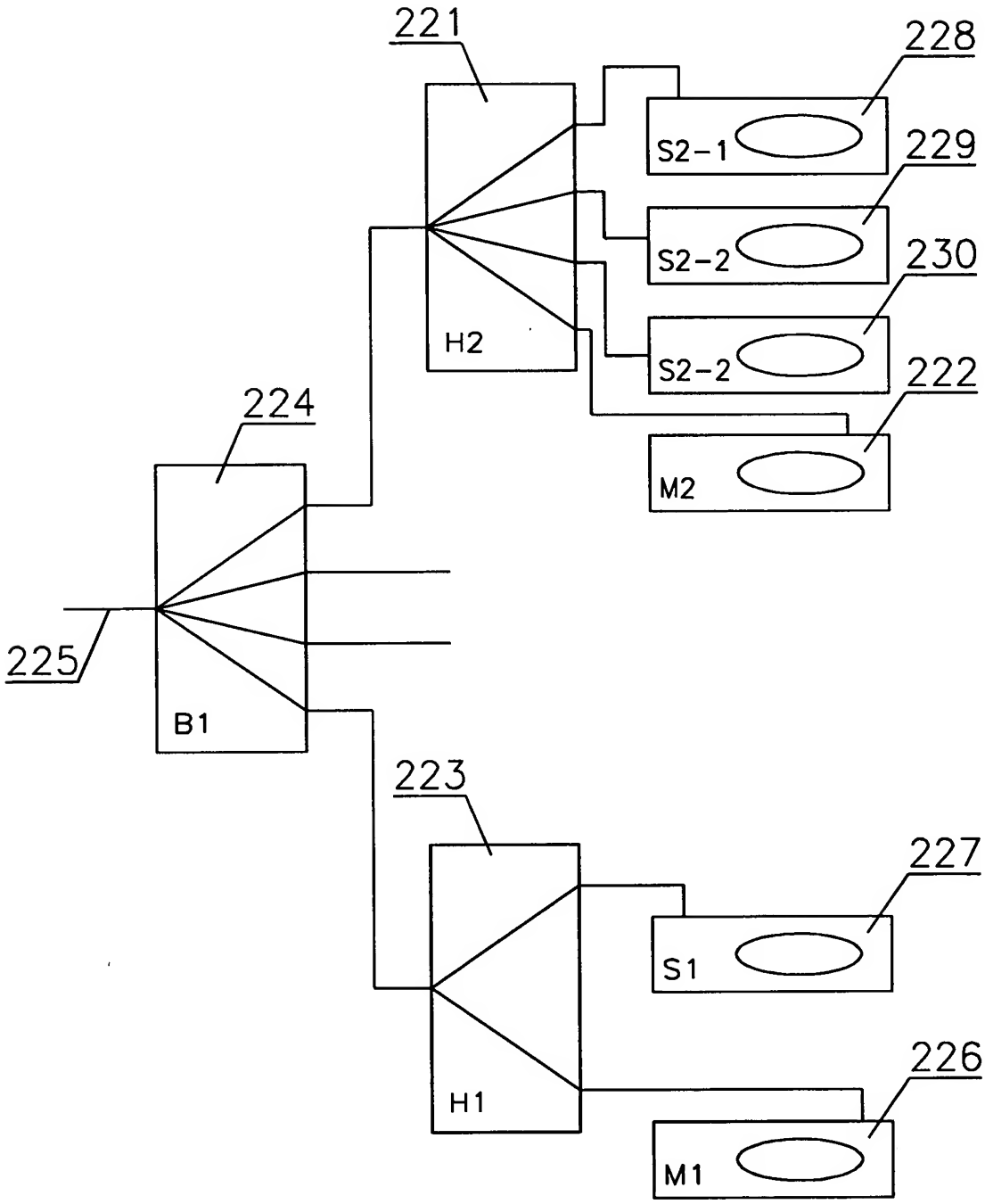

Fig.5

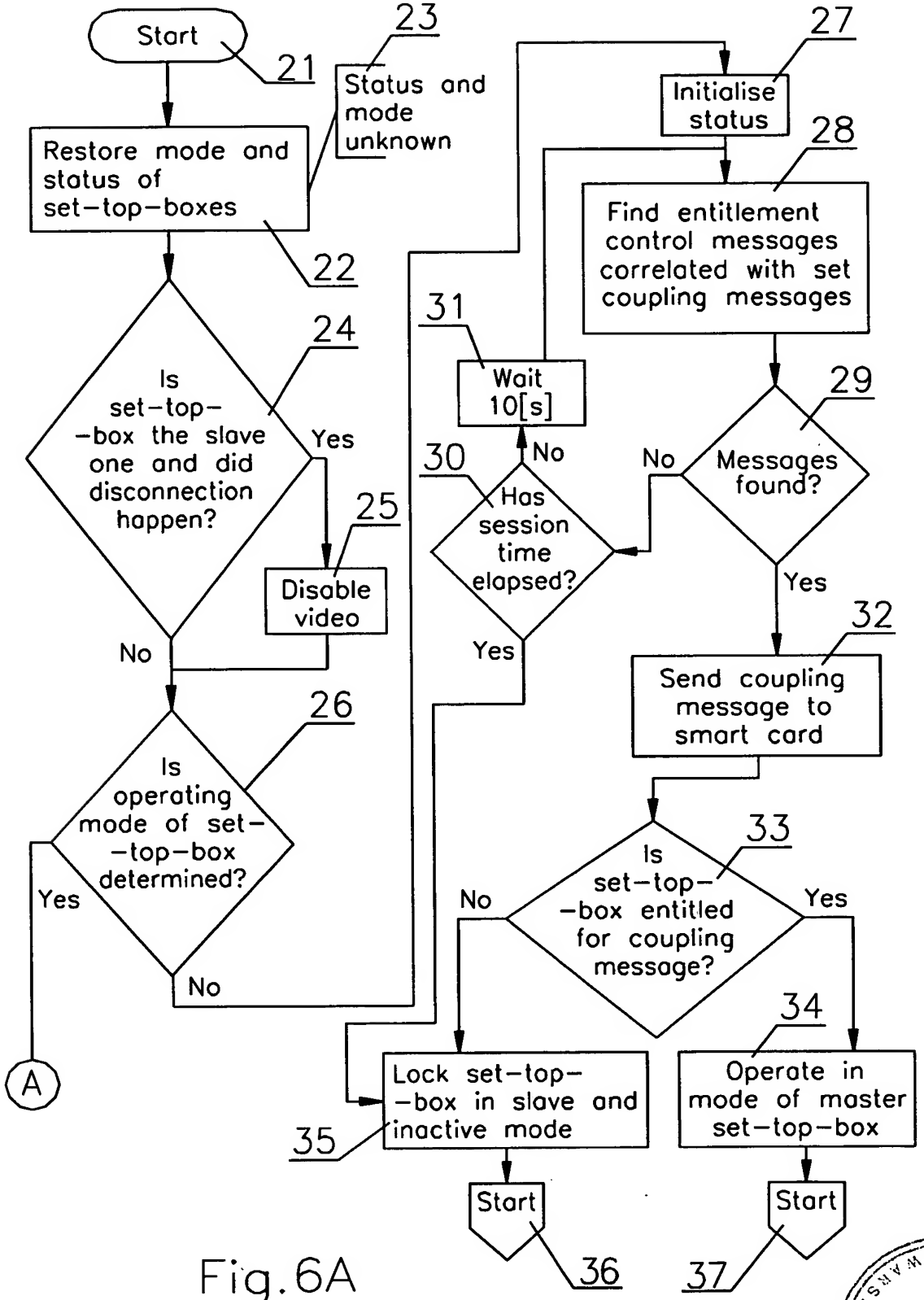
Start
21
23
Status and mode unknown
Restore mode and status of set-top-boxes
22
24
Is set-top--box the slave one and did disconnection happen?
Yes
25
Disable video
No
26
Is operating mode of set--top-box determined?
Yes
No
A
27
Initialise status
28
Find entitlement control messages correlated with set coupling messages
29
Messages found?
No
Yes
31
Wait 10[s]
30
Has session time elapsed?
No
Yes
32
Send coupling message to smart card
33
Is set-top--box entitled for coupling message?
No
Yes
34
Lock set-top--box in slave and inactive mode
35
Operate in mode of master set-top-box
Start
36
Start
37

Fig.6A

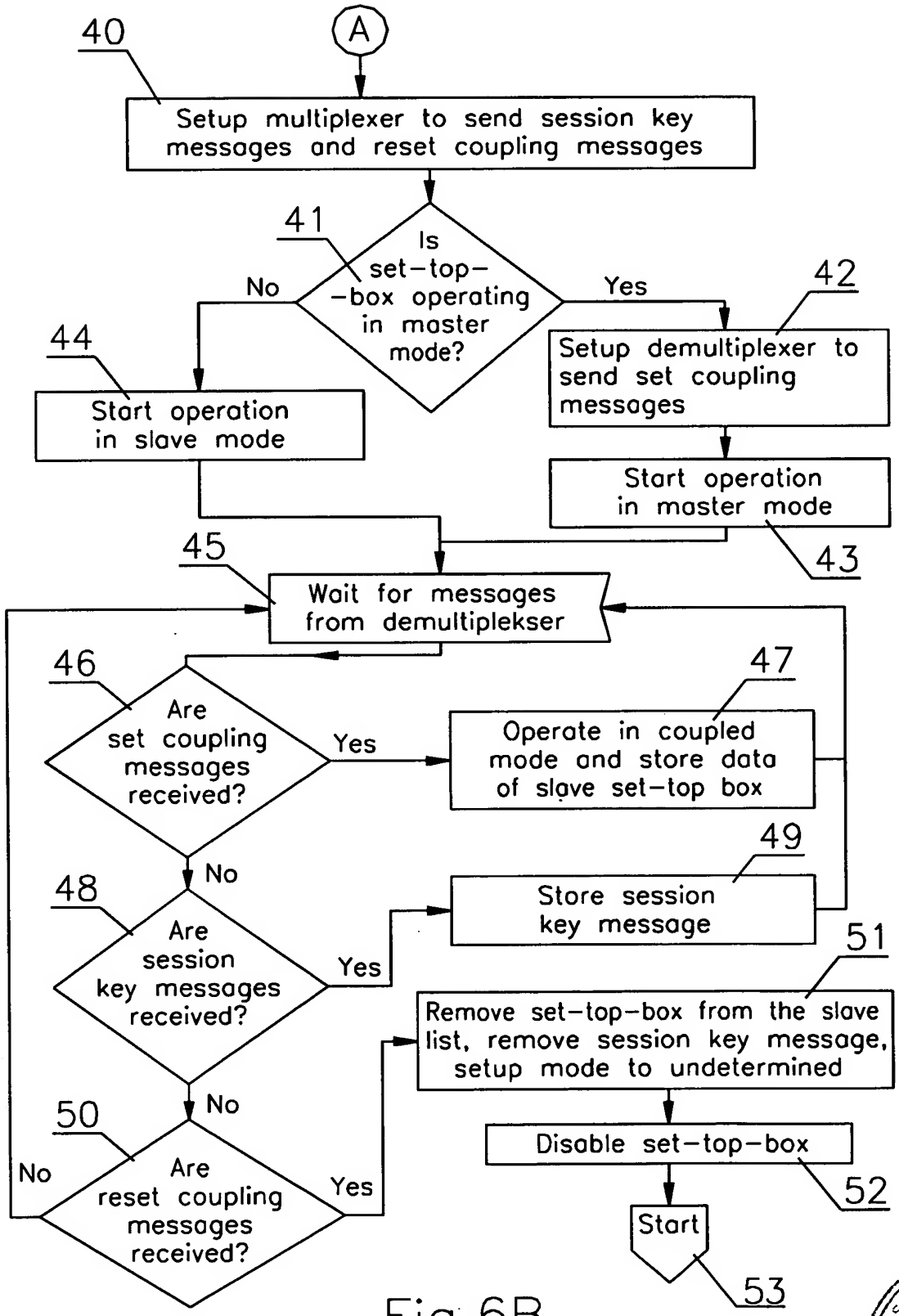
A
40
Setup multiplexer to send session key messages and reset coupling messages
41
Is set-top--box operating in master mode?
No
Yes
42
Setup demultiplexer to send set coupling messages
44
Start operation in slave mode
Start operation in master mode
43
45
Wait for messages from demultiplekser
46
Are set coupling messages received?
Yes
47
Operate in coupled mode and store data of slave set-top box
No
48
Are session key messages received?
Yes
49
Store session key message
51
Remove set-top-box from the slave list, remove session key message, setup mode to undetermined
No
50
Are reset coupling messages received?
No
Yes
Disable set-top-box
52
Start
53

Fig.6B

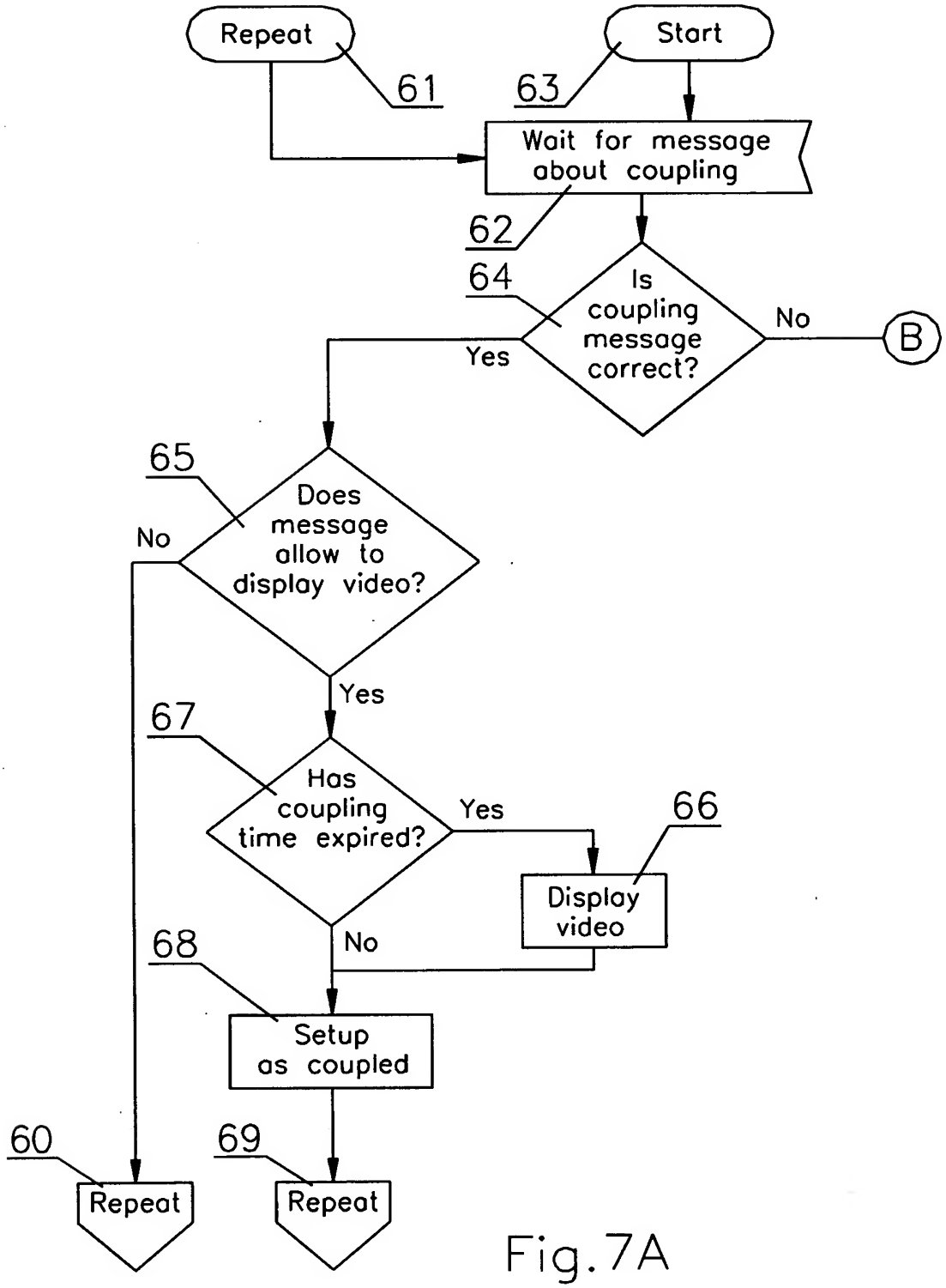
Repeat
61
Start
63
Wait for message about coupling
62
64
Is coupling message correct?
No
B
Yes
65
Does message allow to display video?
No
Yes
67
Has coupling time expired?
Yes
66
Display video
No
68
Setup as coupled
60
Repeat
69
Repeat

Fig.7A

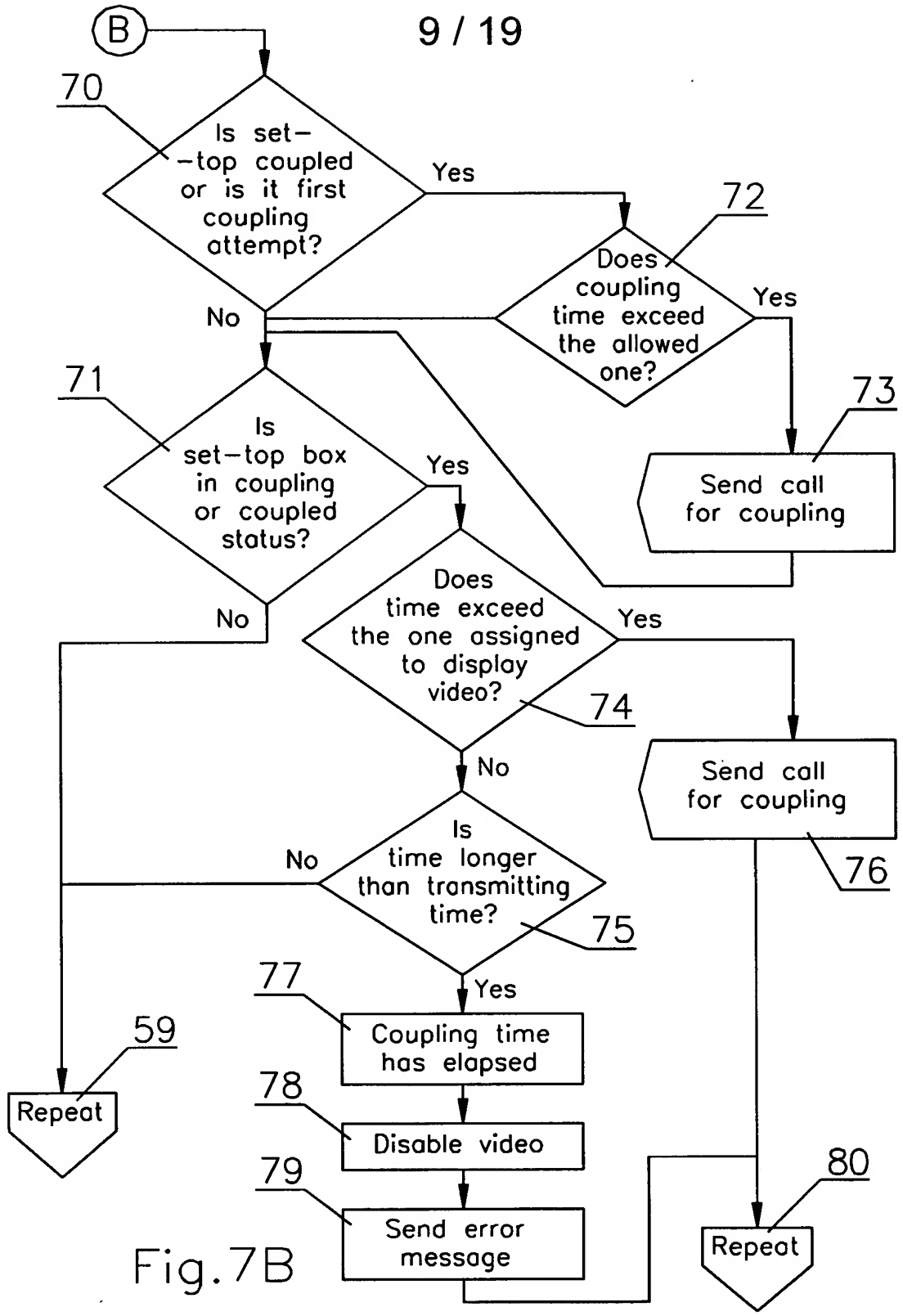
B
70
Is set-top coupled or is it first coupling attempt?
Yes
No
72
Does coupling time exceed the allowed one?
Yes
71
Is set-top box in coupling or coupled status?
Yes
No
73
Send call for coupling
Does time exceed the one assigned to display video?
Yes
74
No
Send call for coupling
76
Is time longer than transmitting time?
No
75
Yes
77
Coupling time has elapsed
59
Repeat
78
Disable video
79
Send error message
80
Repeat

Fig.7B

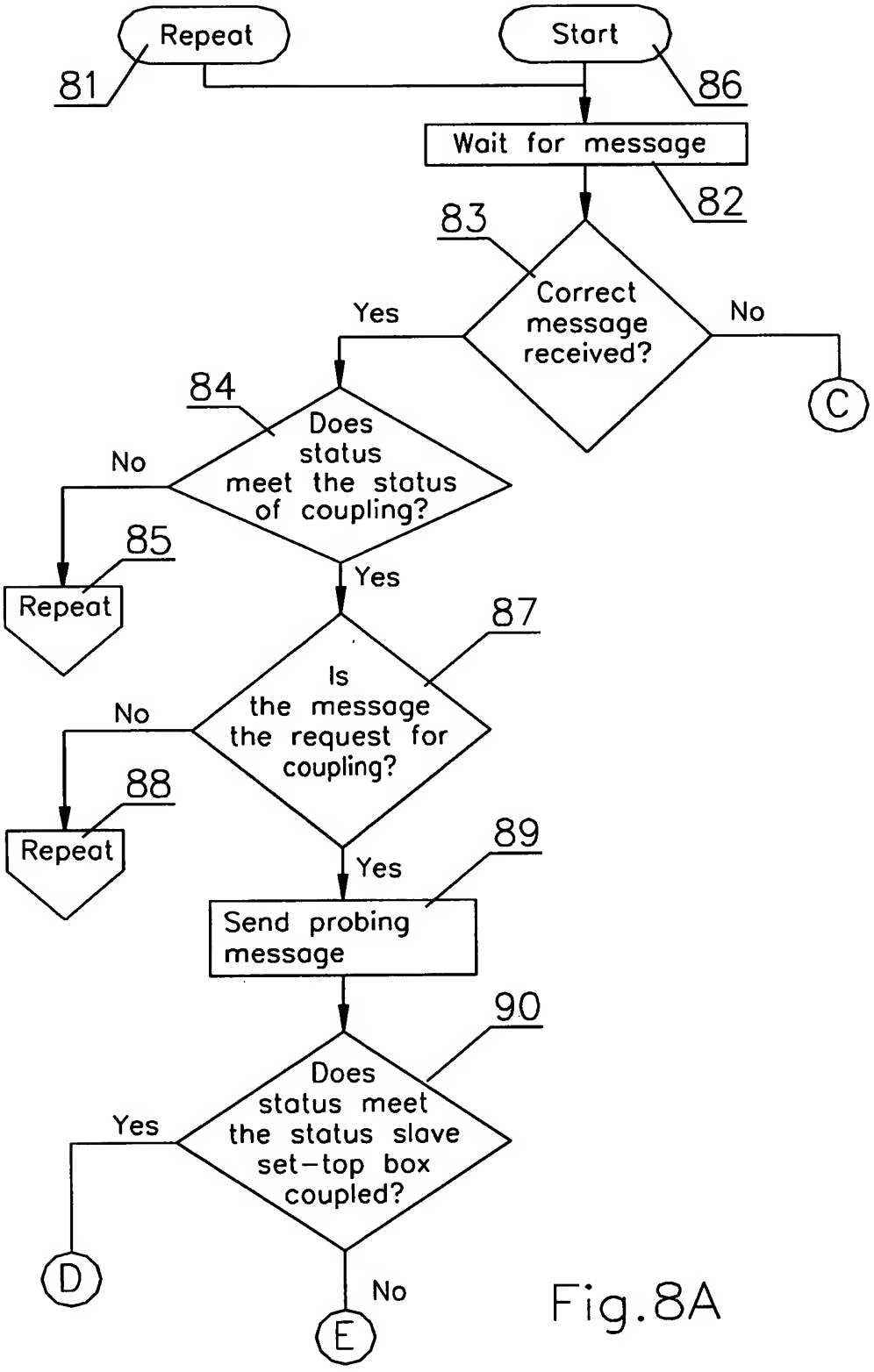

Fig.8A

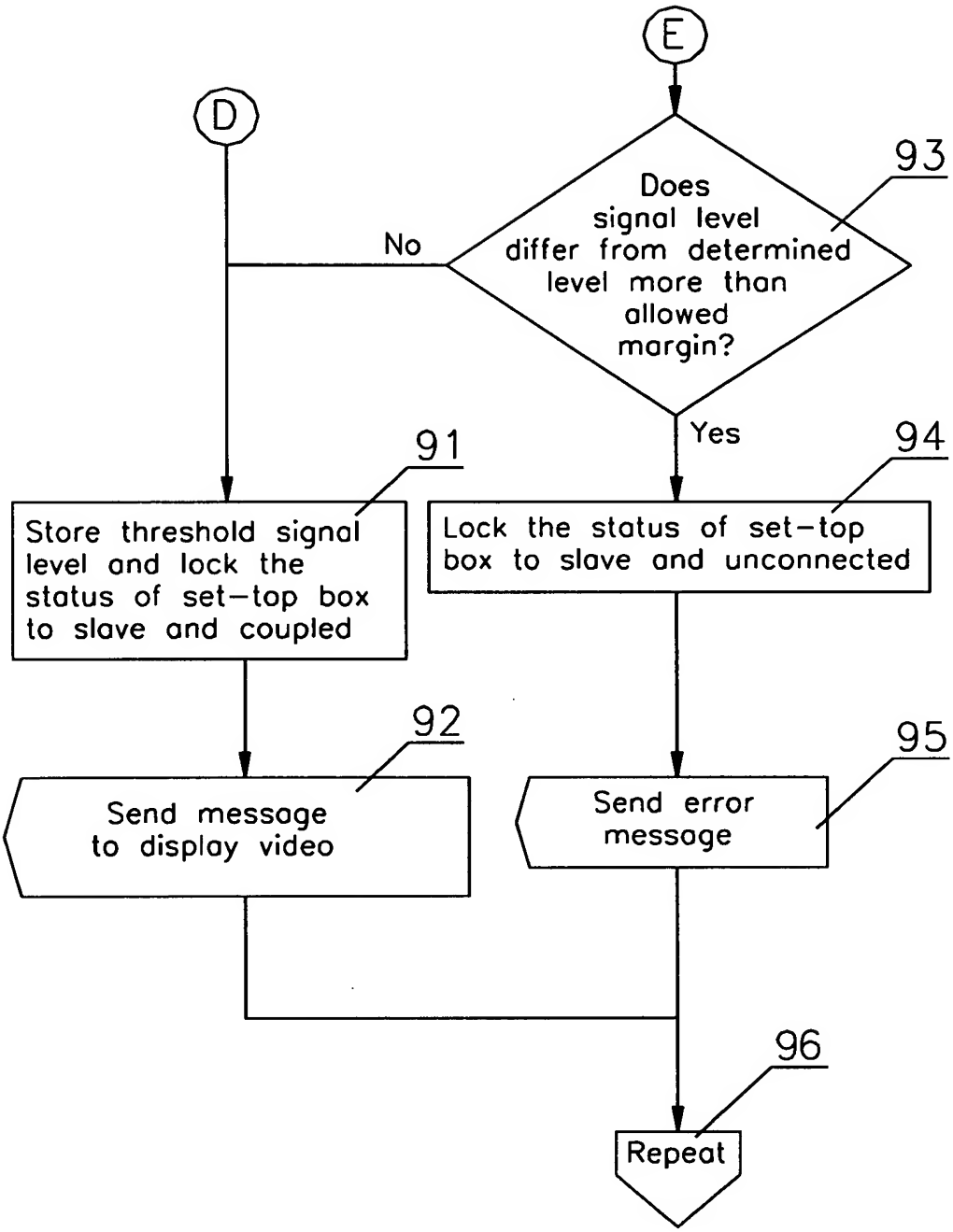
E
D
93
Does signal level differ from determined level more than allowed margin?
No
Yes
91
94
Store threshold signal level and lock the status of set-top box to slave and coupled
Lock the status of set-top box to slave and unconnected
92
95
Send message to display video
Send error message
96
Repeat

Fig.8B

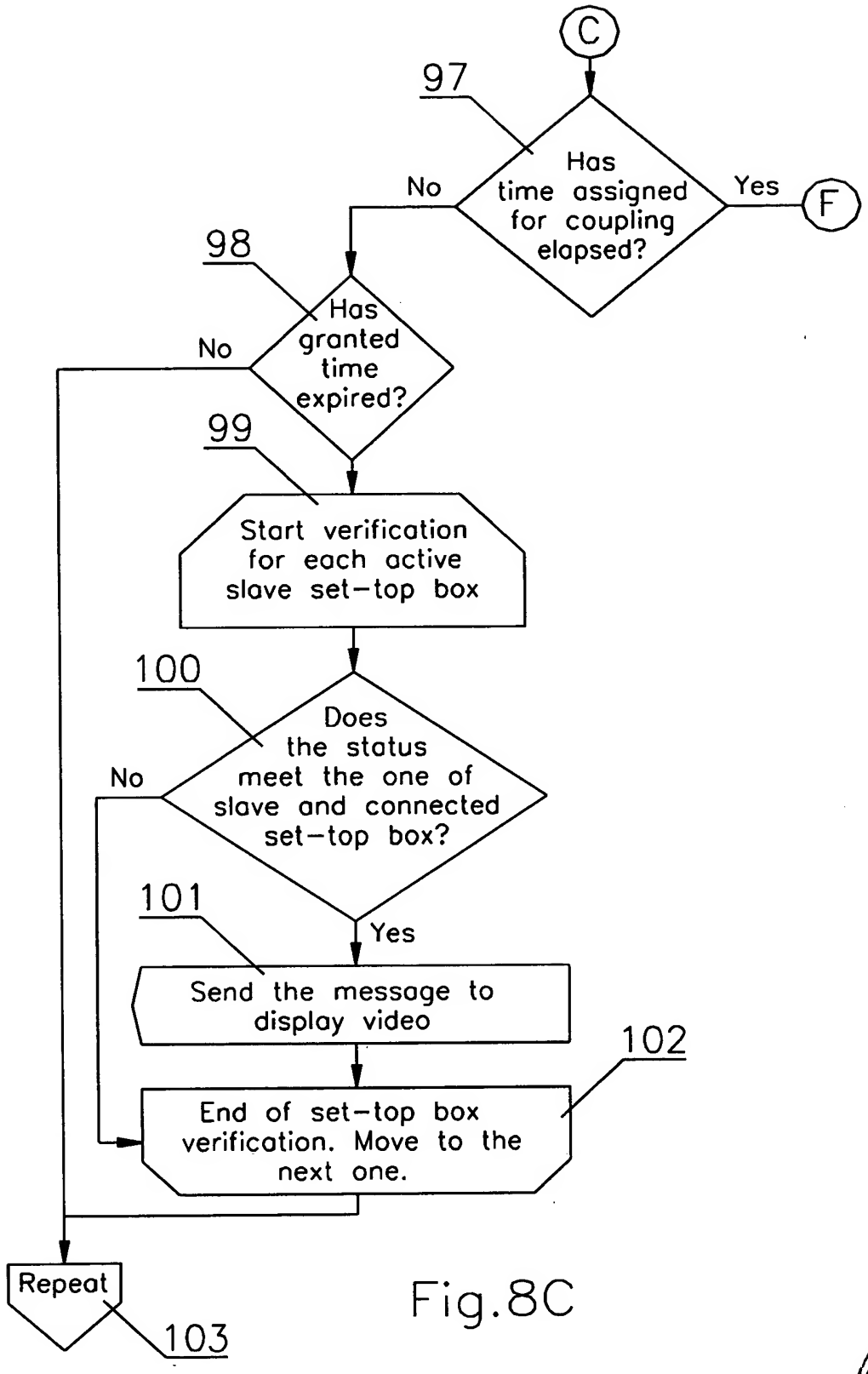

Fig.8C

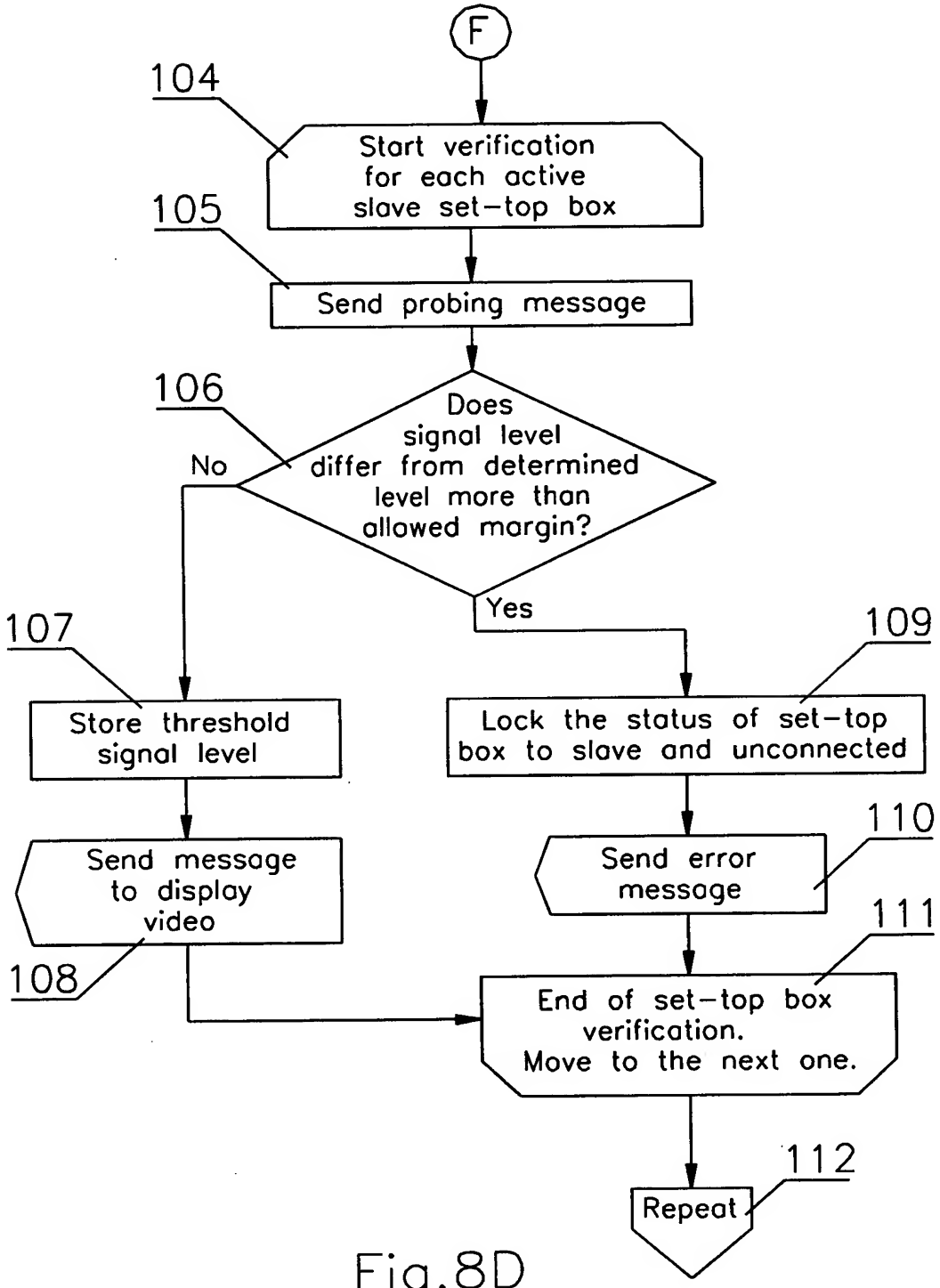

Fig.8D

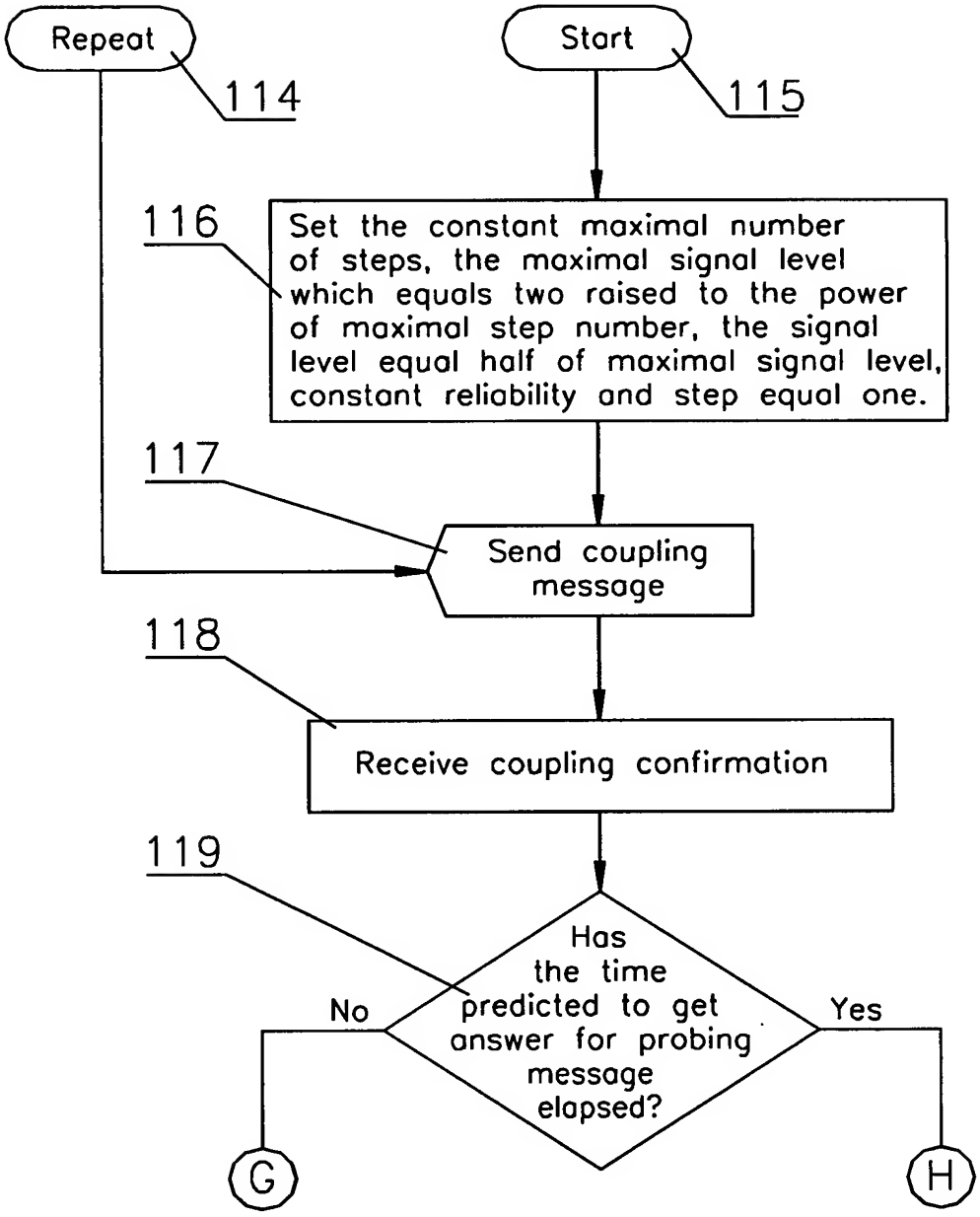
Repeat
114
Start
115
116
Set the constant maximal number of steps, the maximal signal level which equals two raised to the power of maximal step number, the signal level equal half of maximal signal level, constant reliability and step equal one.
117
Send coupling message
118
Receive coupling confirmation
119
Has the time predicted to get answer for probing message elapsed?
No
Yes
G
H

Fig.9A

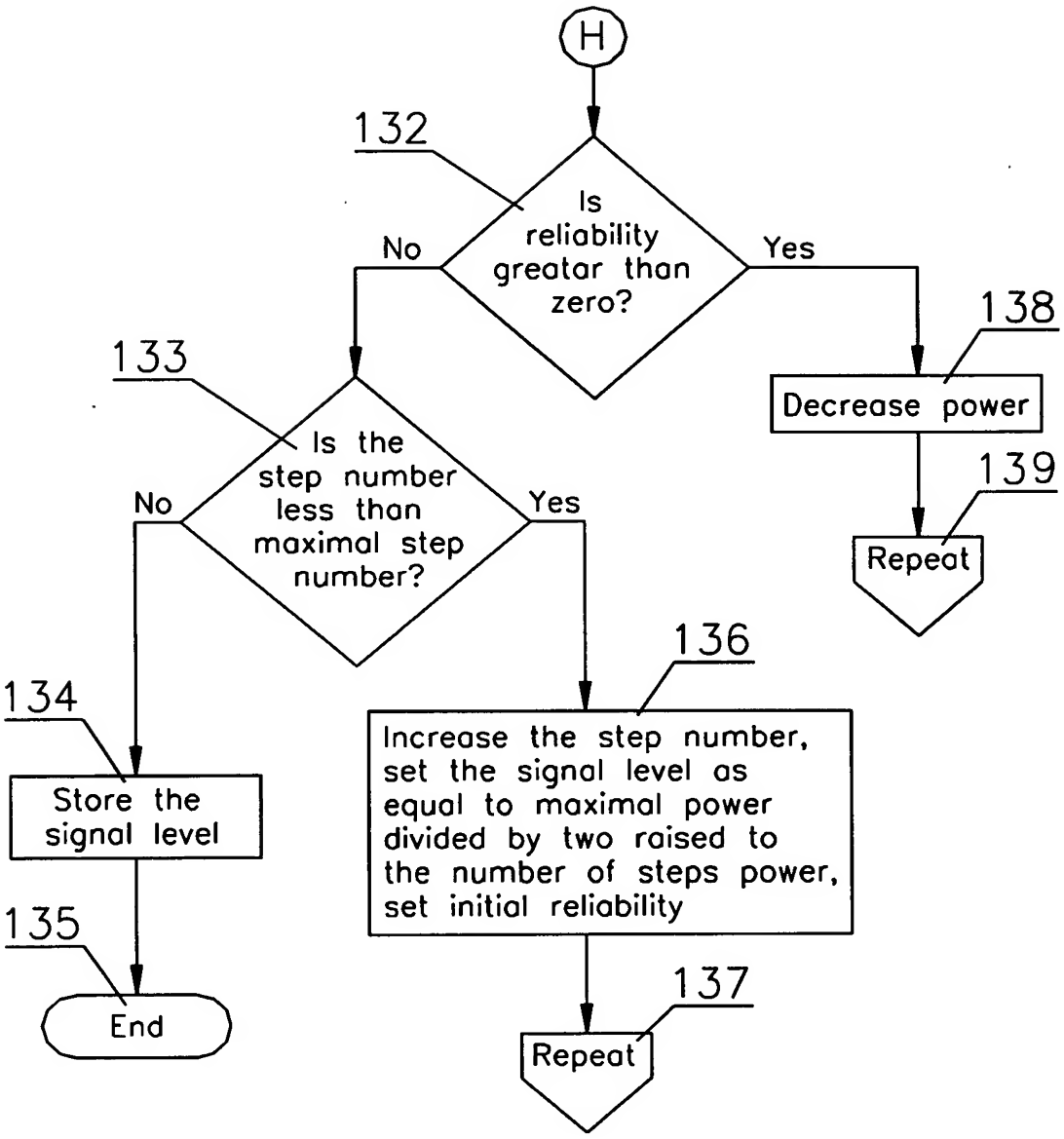

Fig.9B

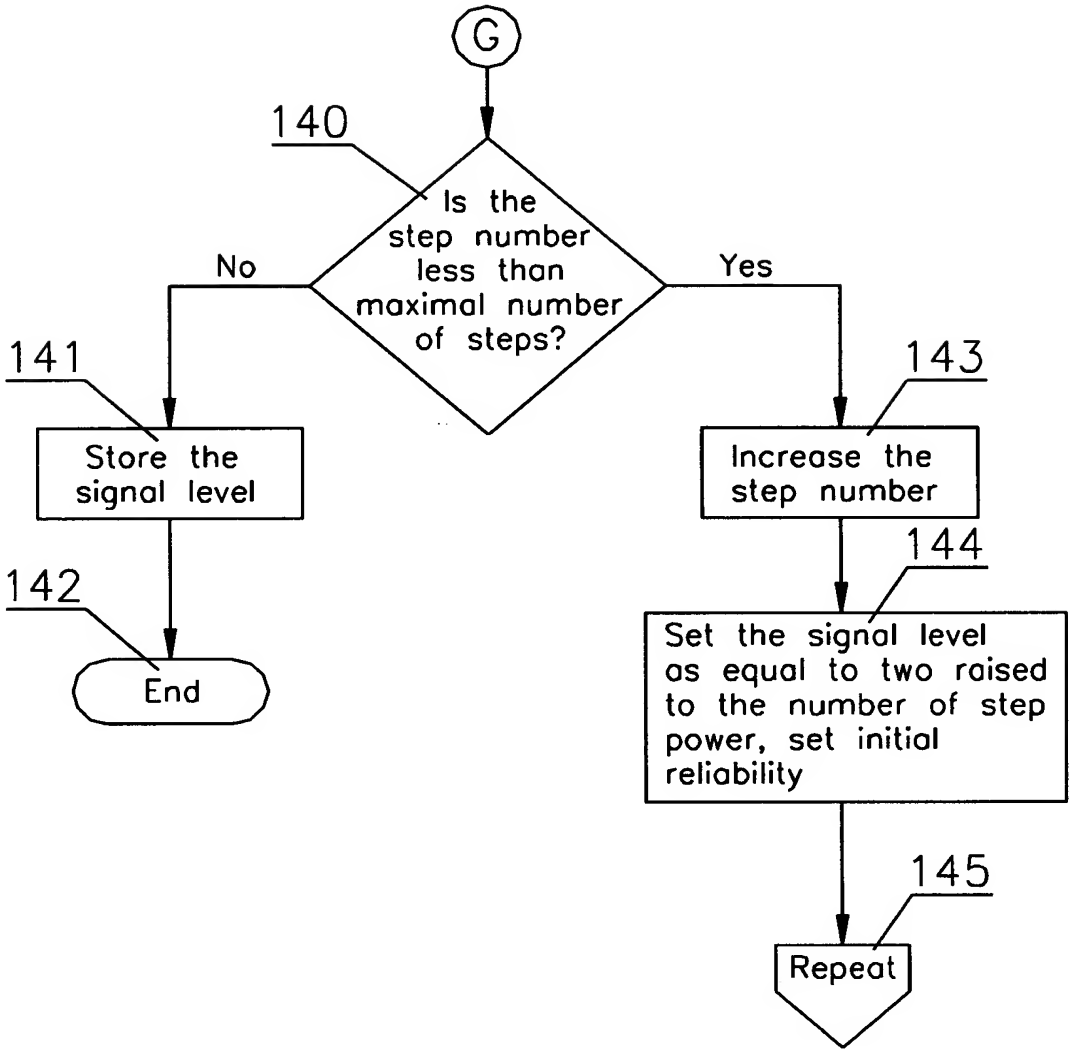
G
140
Is the step number less than maximal number of steps?
No
Yes
141
Store the signal level
142
End
143
Increase the step number
144
Set the signal level as equal to two raised to the number of step power, set initial reliability
145
Repeat

Fig.9C

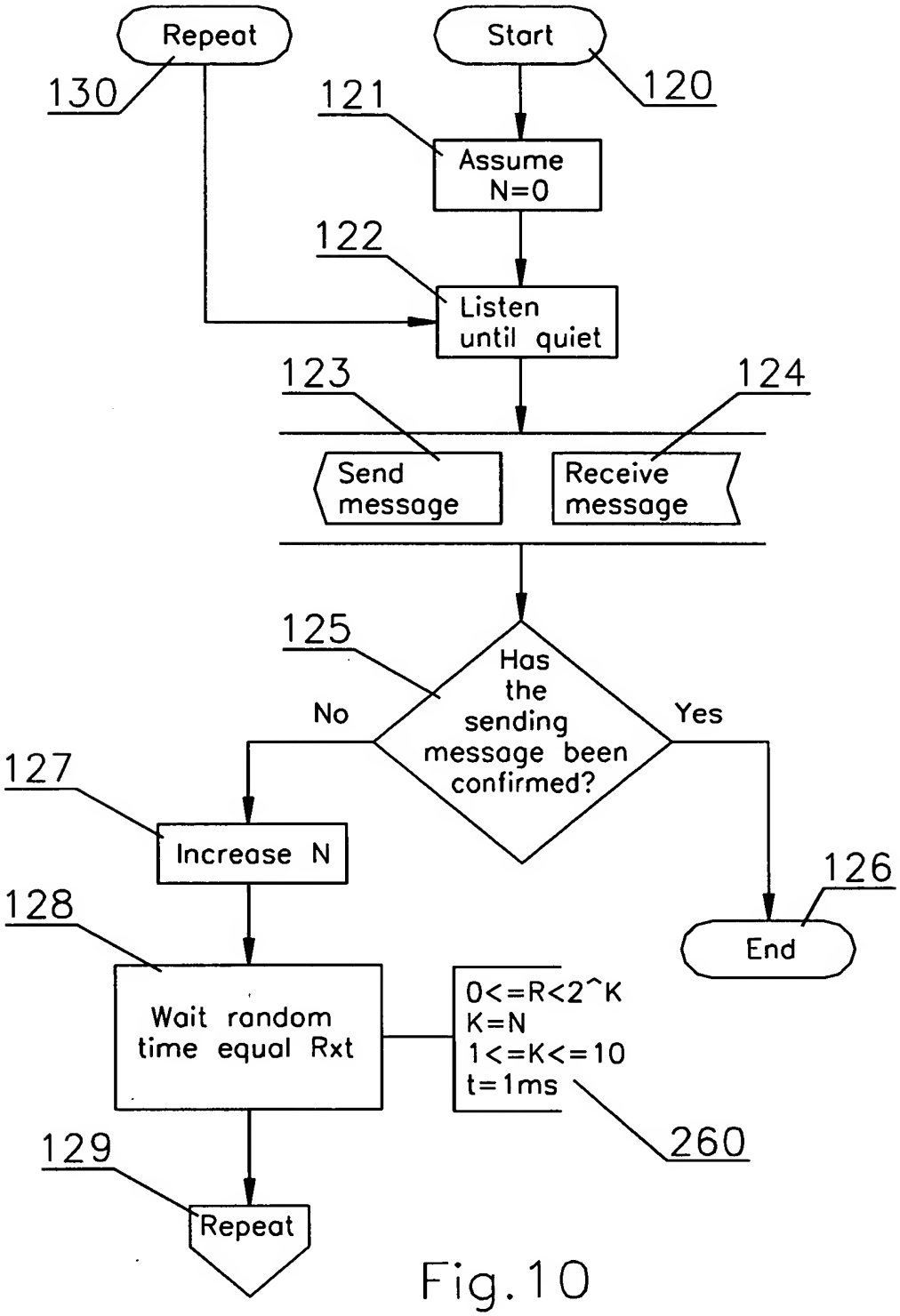
Repeat
130
Start
120
121
Assume
N=0
122
Listen
until quiet
123
124
Send
message
Receive
message
125
Has
the
sending
message been
confirmed?
No
Yes
127
Increase N
126
End
128
Wait random
time equal Rxt
0<=R<2^K
K=N
1<=K<=10
t=1ms
260
129
Repeat

Fig.10

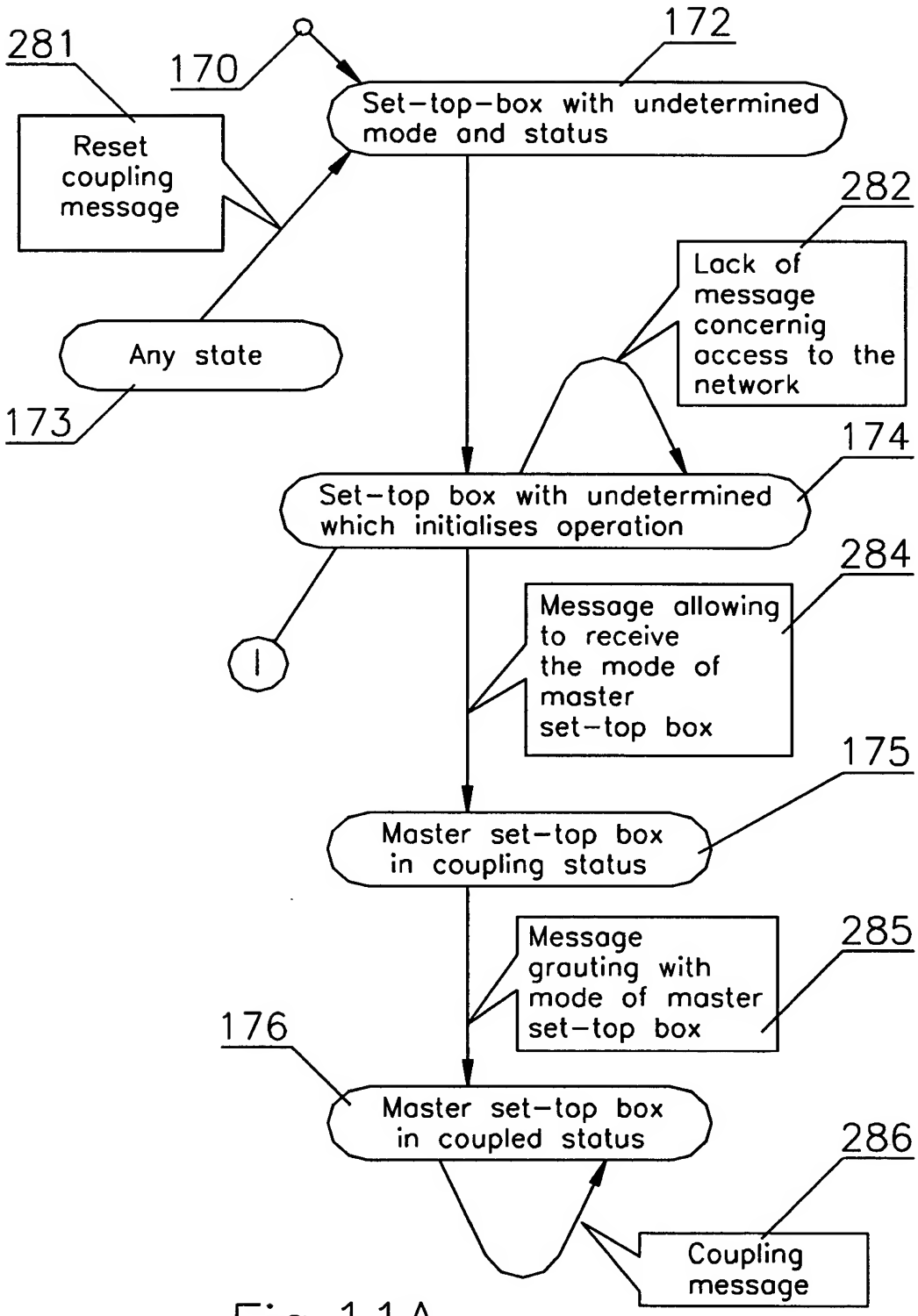
281
170
172
Set-top-box with undetermined mode and status
Reset coupling message
282
Lock of message concernig access to the network
Any state
173
174
Set-top box with undetermined which initialises operation
284
Message allowing to receive the mode of master set-top box
1
175
Master set-top box in coupling status
Message grauting with mode of master set-top box
285
176
Master set-top box in coupled status
286
Coupling message

Fig. 11A

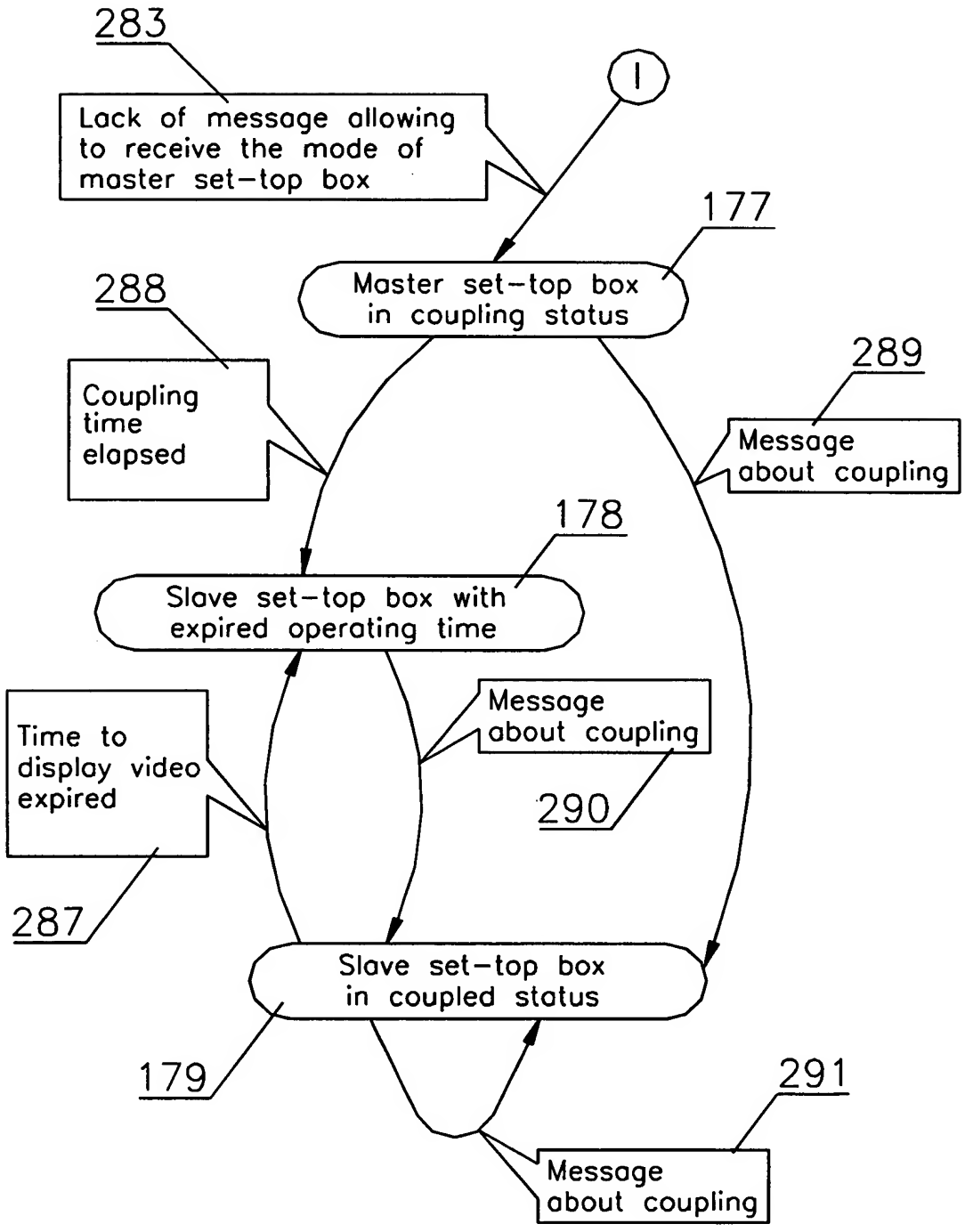
283
Lack of message allowing to receive the mode of master set-top box
1
177
Master set-top box in coupling status
288
Coupling time elapsed
289
Message about coupling
178
Slave set-top box with expired operating time
Message about coupling
290
Time to display video expired
287
Slave set-top box in coupled status
179
291
Message about coupling

Fig.11B

Repertory No.: 617/6/2004

I, the undersigned, Iwona Duma, sworn translator of the English language for the District Court of the City of Warsaw, hereby certify that the above text is a true and complete translation of the Polish document presented to me.

Warsaw, June 21, 2004.